



## Design & Analysis of Algorithms Project

**Project Title:** Cash Settlement Problem

**Aim:** This project aims to find out the simplest cash flow network by minimizing transactions among many people to make things less complicated.

**Project Description:** When there is a large number of transactions among multiple persons, it is difficult to keep a track of the cash flows and how much one owe and to whom. Hence there is a need to simplify the transactions among those persons.

The Splitwise Debt Simplification algorithm is designed to solve such problems. We need to implement that algorithm to find out a simple cash flow network. We have implemented concepts of heap and graph, and used HTML, CSS and JavaScript as tech stack. Node of the graph represents individual and the directed edges represents the cash in or cash out.

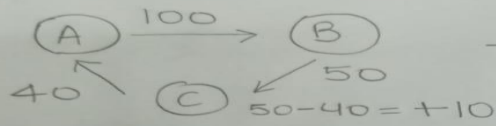
**Project Duration:** 10-12 days

**How to use:**

- 1) Execute the html file(*index.html*) with open server.
- 2) Click on “Get new problem” button to generate random graph which represents the transaction network among multiple people.
- 3) Click on “Solve” button to display the solution. The solution shows the minimized cash flow network among those same individuals.



This is the initial network

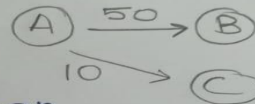


Debit =  $-x₹$

Credit =  $+x₹$

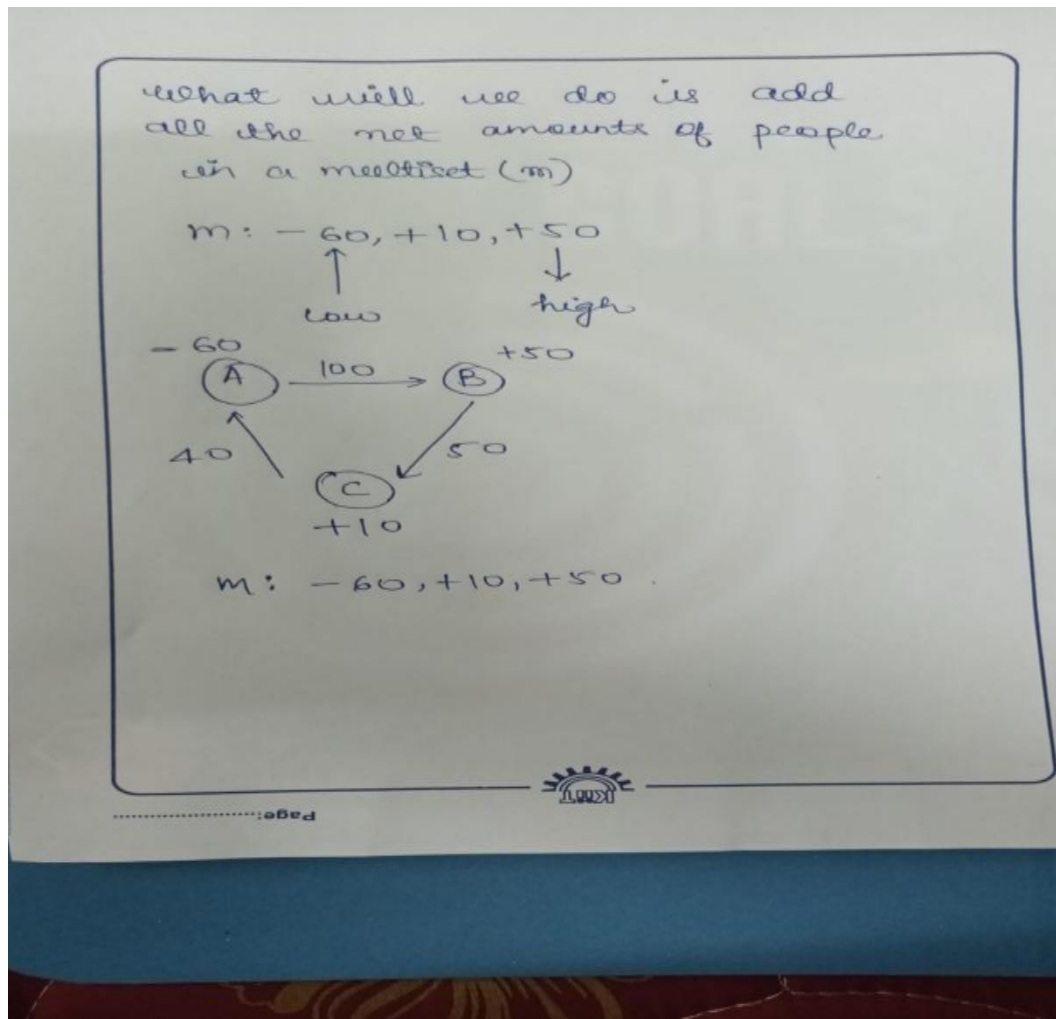
$$\begin{aligned} -40 + 100 \\ 60 \end{aligned}$$

$$\begin{aligned} 100 - 50 \\ = +50 \end{aligned}$$



Using our algo we can simplify the transactions!

Earlier we required 3 transaction  
now we only need 2 transactions



### ABOUT SPLITWISE ALGORITHM DESIGN

This algorithm helps us to make money over network easy. Suppose a group of friends buys something together. Now everyone owes each other different amounts with many people it becomes difficult to keep track of money etc. So this algorithm helps us to make things simpler by minimizing the each transaction to make things less complicated.

### HOW IT WORKS:

A random graph is generated with random values of the edges which represent cash transaction. Once created a min heap is used to solve the graph i.e. settlement of cash. Each person's net balance (the amount they are owed minus the amount they owe) is stored in the min-heap.

The heap being a min heap has the person with the smallest net balance (i.e., the person who is owed the most or owes the least) at the top (root) of the heap. After settling a debt, the algorithm updates the balances of the involved individuals and may push the updated balances back into the min-heap. This ensures that the heap always reflects the current state of debts, allowing the algorithm to continue finding and settling the next minimum debt efficiently. The algorithm iteratively repeats the process of finding and settling the minimum debt until all balances are reduced to zero. In this way a simple transaction network is obtained.

**ADVANTAGE OF OUR PROJECT:**

1. It maintains track of transaction very easily as number of transaction become less.
2. It reduces complexity.

**Contributors:**

1. Anindya Bag (2105260)
2. Dipti Kumari (21051216)
3. Yash Dwivedi (21052379)

**SESSION** : CSE-2(2023)

**SUBMITTED TO:** MS. IPSITA PAUL MAM